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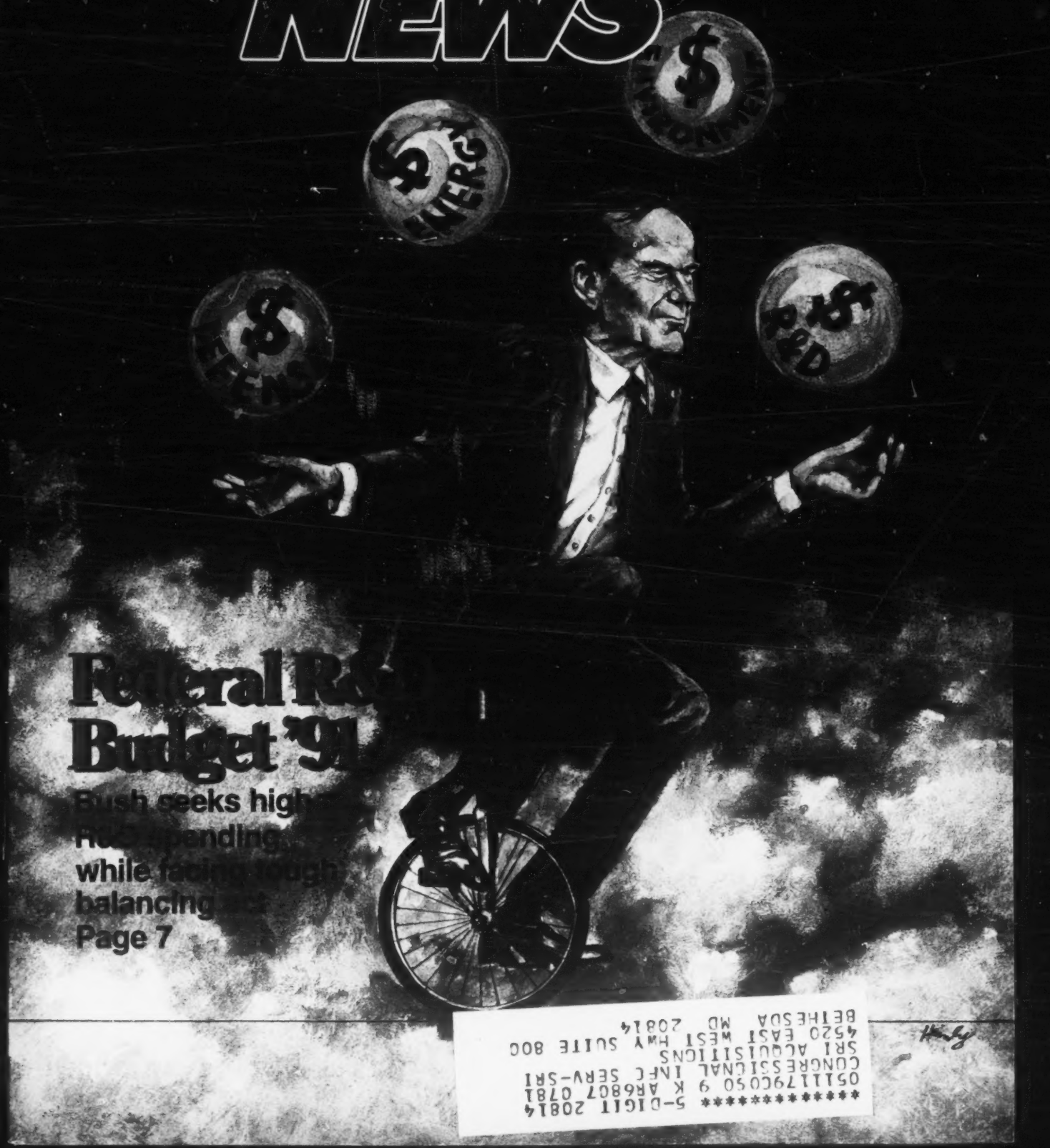
FEBRUARY 12, 1990
CHEMICAL & ENGINEERING

NEWS



Federal R&
Budget '91

Bush seeks high
R&D spending
while facing tough
balancing
Page 7

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CHEMICAL & ENGINEERING
NEWS
Volume 68, Number 7
CENEAR 68 (7) 1-60
ISSN 0009-2347
FEBRUARY 12, 1990

News of the Week

■ **Funding and policy conflicts over big science projects were the focus as White House science adviser testified at House "science posture" hearing.** **Page 4**

■ **New type of gaseous fuel cell that operates at room temperature may provide low-cost source of emergency power.** **Page 5**

■ **At Senate hearing, chemical industry disputes charges that chemicals are being diverted from U.S. firms for production of illegal drugs in Latin America.** **Page 5**

■ **President Bush retains low-key stance on global warming in addressing an international meeting on global climate change held last week in Washington, D.C.** **Page 6**

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Business

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Books

"Blacks, Science, and American Education" relates contributions of early black scientists, assesses current science education of blacks. **Page 28**

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News Focus

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Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K Crum, Executive Director
Robert H. Marks, Director, Publications Division

PUBLISHING BOARD: Jean'ne M. Shreeve *(Chairman); Board of Directors Chairman:* Joseph A. Dixon; *President:* Paul G. Gassman; and four additional members of the Society Committee on Publications yet to be appointed.

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Subscription Rates 1990. Printed editions: nonmembers U.S. 1 yr. $60, 2 yr. $108, outside U.S. 1 yr. $93, 2 yr. $174. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $9.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

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LETTERS

CHEMICAL SAFETY

9,9-dichlorofluorene

SIR: Two of our students recently synthesized 9,9-dichlorofluorene. Neither the paper describing the synthesis they used [Ray, F. E., Albertson, C. E., *J. Am. Chem. Soc.*, **70**, 1954 (1948)] nor the original synthesis [Smedley, I., *J. Chem. Soc.*, **87**, 1249 (1905)] made mention of any sensitivity from this compound.

One of our students subsequently spilled a solution of the 9,9-dichlorofluorene in hot glacial acetic acid on her hand. A rash soon developed locally and subsided, but within a week reappeared as a severe case of dermatitis, which spread to both arms, legs, and her face, with accompanying itching and swelling. A literature search revealed a similar reaction to 9,9-dibromofluorene [Sampey, King, Roe, Childress, *Science*, **621** (1947); Sampey, Childress, *J. Am. Chem. Soc.*, **70**, 1979 (1948)]. For our student, even with treatment with Benadryl and steroids, the dematitis was severe for a week and slowly subsided over the next few weeks. We caution others about working with this compound.

Terry L. Newirth
Associate Professor
Haverford College

Editor's note: The Chemical Manufacturers Association and other authorities recommend immediate flushing with cold running water for at least 15 minutes following chemical contact with human skin.

Photography's roots

SIR: Congratulations on providing what is probably the best short-form 20th century survey of the technologies of the launch of photography to your readers (C&EN, Dec. 18, 1989, page 26). John L. Ennis is to be commended for the mix of chemistry and sociology, which keeps the years and breakthroughs so firmly separated.

But a few adjustments will be of equal interest. The ambrotype, immediate major successor to the daguerreotype, did not capture the market because of public demand for portraits in the daguerreotype mode. Photographers gratefully rushed to ambrotypy, a simpler process without need for the costly silver-plated copper; with an image visible from any direction in any light; and broadening the market with a lower cost per image. It was made on the glass previously stocked as cover panels for the fragile daguerrean image.

The photographers used existing camera cases and all of the existing leather cases necessary to protect glass covering the daguerrean images. It was a speedy transition from a complicated procedure to a safer (no mercury), lower priced system. On-paper photography displaced the on-glass images within a few years.

The tintype (ferrotype, melainotype) was patented (not invented) by Hamilton Smith and his student Peter Neff, whose farmer-father financed the effort. It was invented in 1853 in France by chemist Adolph Alexandre Martin (1824–96) and was patented there in the same year as the U.S. patent (1856). Earlier, in 1853, the process was used by Giles Langdell of Philadelphia to make images on black paper (melanographs, atrographs).

The tintype succeeded because it made possible the penny picture (12 for 10 cents) at the time of the Civil War. The public saw the first image of Abraham Lincoln on the 5-cent campaign button of the election that made him president. The patents were not enforceable. Neff left photography.

Finally, Daguerre did not make his camera (your caption on page 35). The equipment came from the optical shop of his camera obscura supplier, Chevalier of Paris; after June 1839, the body and necessary fuming boxes came from cabinetmaker Alphonse Giroux, a relative of Daguerre's wife. Giroux also made the cameras that he and Daguerre then sold following demand created by the government's August 1839 announcement.

Interest in photography's roots during 1989 led to your essay among others in the popular press and also to found-

Corrections

- Dec. 18, 1989, page 16: The new composites encyclopedia is entirely the product of VCH Verlagsgesellschaft's American subsidiary VCH Publishers, New York City.
- Oct. 16, 1989, page 61: The blood cells termed polymorphonuclear leukocytes are, instead, macrophages.
- Jan. 15, page 28: The studies of synthetic diamond films were made by Teruo Yagishita of Fujitsu Laboratories, not Teruo Yagashita.

President Proposes 7% Increase in Federal R&D Funding for 1991

Although proposed funding increase seems sizable compared with the total federal budget, most of the total R&D increase is aimed at space station, Strategic Defense Initiative, AIDS, and other "big-ticket" items

Janice R. Long and Pamela S. Zurer, C&EN Washington

In his first comprehensive budget proposal to Congress, President Bush calls for increases in federal R&D funding that are much larger than the total budget increase of 3% to $1.23 trillion. For example, in the budget proposal, obligations for the conduct of R&D for fiscal 1991 would be up 7%, or $4.4 billion, over current levels, to $68.1 billion. Within that amount, obligations for civilian R&D would rise 12% to $26.7 billion, and obligations for defense R&D, conducted by both the departments of Defense and Energy, would be up only 4% to $41.4 billion.

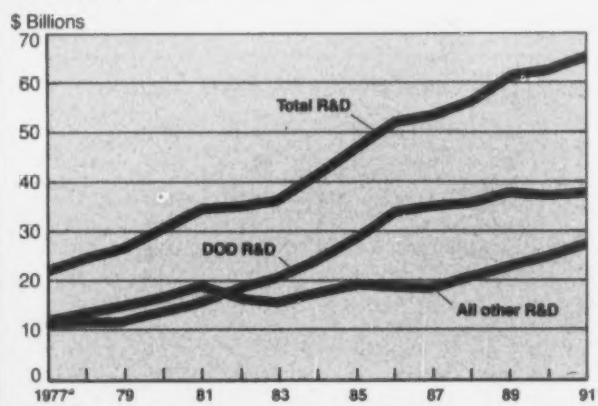
Total funding for basic research would increase 8% to $12.4 billion, accounting for about 18% of the total federal R&D budget. Civilian basic research would be up about 9% to $11.4 billion, and defense basic research would be up 6% to just under $1 billion.

An additional $3.1 billion would be earmarked for construction, repair, and modernization of R&D facilities, bringing total proposed federal support for R&D to $71.2 billion, an increase of 7% over fiscal 1990 funding levels.

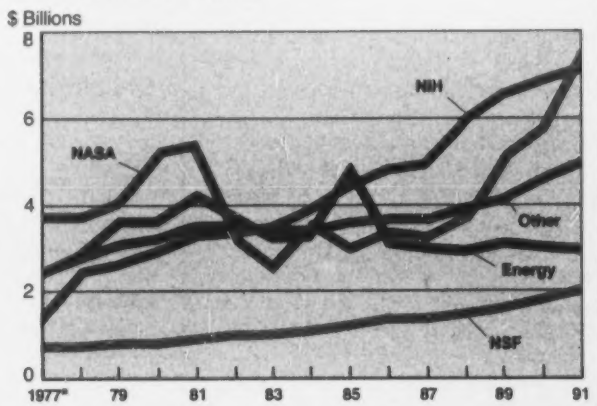
Although these proposed increases look quite healthy, in a relatively anemic budget, there are some caveats. First, over 70% of the increased funding for civilian projects is earmarked for a number of "big-ticket" programs. The fiscal 1991 budget, according to the Office of Management & Budget, calls for:

- A 36%, $699 million, increase to $2.6 billion for Space Station Freedom.
- An 18%, $531 million, increase to $3.5 billion for all aspects of the federal response—including research, prevention, and treatment—to acquired immune deficiency syndrome (AIDS).
- A 47%, $408 million, increase to $1.3 billion for

DOD's share of R&D spending falls to 57% . . .



. . . and NASA accounts for 31% of nondefense R&D



Note: Outlays. Source: Office of Management & Budget

programs aimed at carrying out the President's goal of manned exploration of space beyond Earth's orbit.

- A 57%, $375 million, increase to $1.0 billion to ensure the U.S.'s world leadership role in climate change research.
- A 6%, $213 million, increase to $3.5 billion for biotechnology R&D programs.
- A 46%, $100 million, increase to $318 million for the Superconducting Super Collider.

Another "big-ticket" project, the Strategic Defense Initiative, accounts for 65% of the $1.4 billion increase slated for DOD's R&D programs.

Another caveat is that increases in R&D funding are being calculated from a deceptively low base. That's because to meet the fiscal 1990 deficit target Congress partially went along with an across-the-board cut in fiscal 1990 federal funding, including R&D funding, ordered by President Bush last October in accordance with the requirements of the "Balanced Budget & Emergency Deficit Control Reaffirmation Act of 1987." Bush had ordered cuts of 4.3% for defense programs and 5.3% for nondefense programs. Congress lowered those percentages to 1.5% and 1.4%, respectively, a lesser cut, but still a cut.

In addition, the President's budget proposal is only a starting point. It is Congress, through the authorization and appropriation process, that finally decides how much each agency can spend on what. In the early 1980s it was almost axiomatic that Congress would provide more money than requested for R&D programs, but that pattern has changed recently. Over the past three fiscal years, Congress has provided the total amount requested by the Administration for the conduct of R&D just once, providing 5% less than the requested level in the other two years. However, it did manage to provide slightly more, about 2%, than was requested for basic research.

The differences between the requested amount for agency research programs and what they

TOTAL FEDERAL R&D BUDGET PROPOSAL

Federal R&D funding breaks down like this

$ Millions	Obligations 1991	Obligations 1990	Obligations % change 1990–91	Outlays 1991	Outlays 1990	Outlays % change 1990–91
BY AGENCY						
Defense[a]	$38,714	$37,226	4%	$37,547	$37,064	1%
Health & Human Services	8,933	8,506	5	8,568	8,055	6
NASA	8,414	6,382	32	7,547	5,773	31
Energy	6,058	6,023	1	6,019	5,599	7
NSF	1,983	1,766	12	1,944	1,744	11
Agriculture	1,184	1,108	7	1,156	1,084	7
Interior	493	503	−2	499	469	6
EPA	460	431	7	435	393	11
Commerce	443	425	4	406	441	−8
Transportation	422	336	26	426	387	10
Agency for International Development	214	230	−7	289	306	−5
Veterans Affairs	201	215	−6	205	214	−4
Other agencies	621	561	11	592	556	6
BY FUNCTION						
Basic research	**12,366**	**11,398**	**8**	**11,886**	**10,961**	**8**
Civilian	11,372	10,459	9	10,911	10,016	9
Defense[a]	994	939	6	975	945	3
Applied R&D	**55,773**	**52,313**	**7**	**53,745**	**51,124**	**5**
Civilian	15,346	13,375	15	14,449	12,321	17
Defense[a]	40,427	38,938	3	39,296	38,803	1
TOTAL	**$68,140**	**$63,712**	**7%**	**$65,633**	**$62,085**	**6%**

Note: All numbers are estimates that exclude R&D facilities funding. a Includes military-related R&D programs of the departments of Defense and of Energy. **Source:** Office of Management & Budget

Funding for basic research is up 8%

$ Millions	Obligations 1991	Obligations 1990	Obligations % change 1990–91	Outlays 1991	Outlays 1990	Outlays % change 1990–91
Health & Human Services	$4,993	$4,714	6%	$4,763	$4,483	6%
NSF	1,853	1,651	12	1,820	1,632	12
NASA	1,823	1,596	14	1,640	1,445	13
Energy	1,658	1,512	10	1,676	1,499	12
Defense-military	978	924	6	959	929	3
Agriculture	553	511	8	525	503	4
Other agencies	508	489	4	504	470	7
TOTAL	**$12,366**	**$11,397**	**8%**	**$11,887**	**$10,961**	**8%**

Note: All numbers are estimates. **Source:** Office of Management & Budget

Only three agencies get more money for R&D facilities

$ Millions	Obligations 1991	Obligations 1990	Obligations % change 1990–91	Outlays 1991	Outlays 1990	Outlays % change 1990–91
Energy	$1325	$1139	16%	$1195	$1057	13%
NASA	846	850	−1	720	628	15
Defense-military	458	639	−28	489	545	−10
NSF	153	119	28	75	64	18
Agriculture	103	118	−13	128	148	−13
Health & Human Services	96	77	25	60	77	−22
Other agencies	78	80	−3	71	70	1
TOTAL	**$3059**	**$3022**	**1%**	**$2738**	**$2589**	**6%**

Note: All numbers are estimates. **Source:** Office of Management & Budget

receive has been greater. For example, the National Aeronautics & Space Administration has consistently received 7% less than it wanted for R&D. The Department of Defense's R&D budgets have been underfunded by 2 to 14%, and NSF has been coming in at 3 to 9% under budget. The Department of Energy's R&D funding usually has been right on target. The budget for the National Institutes of Health has gone from 23% above the requested level to 8% under and back up to 2% over its request. So it's hard to predict how Congress will respond to the current R&D budget request, except to say that changes will be made.

Defense Department. If Congress once again decides that DOD's R&D budget offers a tempting target for savings, it will fall well behind what is needed just to keep pace with inflation, which the Office of Management & Budget predicts will be running at a rate of 4% in fiscal 1991. That's exactly the percent increase being sought for DOD's research, development, test and evaluation programs in fiscal 1991, up 4% to $38.1 billion.

Funding for basic research, which actually fell 3% in fiscal 1990, would be up 6% to $978 million, but it still would account for only 2.5% of total RDT&E funding. In a briefing on the overall federal R&D budget, Presidential Science Adviser D. Allan Bromley said that the 6% increase was necessary to protect the U.S. "from being blindsided by technological breakthroughs during a time of reduced tensions" worldwide.

Bromley also said that it is extra important right now for DOD and the academic research community to rebuild their bridges of communication, which were disrupted during the 1970s when DOD was prohibited from funding any basic research not directly related to its military missions. He maintains that DOD needs contact with the bright young minds in universities, noting that the universities, in turn, can use its support. However, the 3% increase to $98.7 million requested for DOD's university research initiative won't provide for a whole lot of contact.

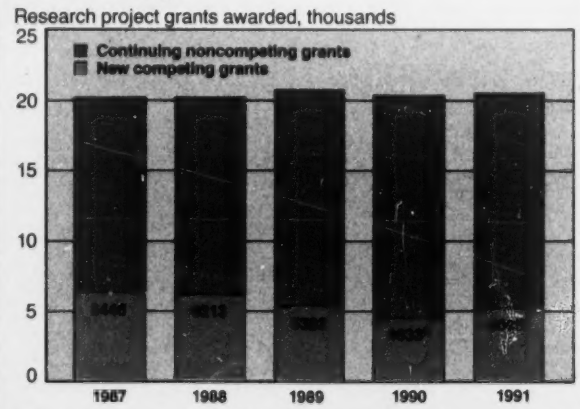
Basic research gets less than 3% of DOD R&D

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Advanced development	$11,106.8	$10,340.3	$10,375.6	7%
Engineering development	10,941.7	11,301.9	11,413.2	−3
Operational systems development	9,759.9	9,219.1	9,416.9	6
Management and support	2,849.1	2,530.1	2,808.4	13
Exploratory development	2,457.5	2,403.1	2,540.8	2
Research	977.8	923.5	950.7	6
TOTAL	$38,092.8	$36,718.0	$37,505.6	4%

Note: Obligations. a Estimate. b Actual. Source: Department of Defense

Health & Human Services. Most R&D funding at HHS goes to the National Institutes of Health, whose budget Bush proposes to increase 5% to $7.9 billion. However, the added funds would not be distributed equally across all the research areas NIH supports. R&D addressing AIDS would rise 8% to $800 million, but the budget for mapping and sequencing the human genome would rise 82% to $108 million. If funds for those two areas are removed from the equation,

New grants from NIH have slipped from '87 high



a Estimate. Source: National Institutes of Health

Human genome project up 82% at NIH

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
National Institutes	$7189.6	$6893.8	$6569.3	4%
Cancer	1694.1	1634.3	1572.9	4
(AIDS)	(160.8	150.3	124.1	7)
Heart, Lung & Blood	1112.5	1072.3	1046.3	4
(AIDS)	(44.5	42.1	38.6	6)
Allergy & Infectious Disorders	886.9	833.0	743.9	6
(AIDS)	(423.4	394.0	312.9	7)
General Medical Sciences	745.5	712.0	683.9	5
(AIDS)	(15.5	14.6	10.9	6)
Diabetes & Digestive & Kidney Diseases	605.4	581.5	559.9	4
Neurological Disorders & Stroke	512.2	490.4	472.7	4
(AIDS)	(17.2	16.2	13.4	6)
Child Health & Human Development	461.5	442.9	425.9	4
(AIDS)	(29.0	26.7	22.7	9)
Aging	248.9	239.5	222.9	4
Eye	247.4	236.5	231.4	5
Environmental Health Sciences	235.8	229.2	223.7	3
Arthritis & Musculoskeletal & Skin Diseases	176.1	168.9	160.1	4
Dental Research	140.5	135.7	131.0	4
Deafness and Other Communication Disorders	122.8	117.6	94.7	4
National Center for Human Genome Research[c]	108.0	59.5	28.2	82
Division of Research Resources	319.2	337.1	340.9	−5
Other	313.0	285.9	206.5	9
TOTAL	$7929.8	$7576.3	$7144.9	5%

Note: Obligations for AIDS research are included in totals for each institute. Subtotals for AIDS are broken out where they exceed $10 million. a Estimate. b Actual. c Previously included in budget of National Institute of General Medical Sciences. Source: National Institutes of Health

basic research at NIH would get only a 4% increase—about even with the rate of inflation.

The overall NIH budget includes $4.4 billion for 20,439 research project grants—the primary source of funds for basic biomedical research—roughly 120 more grants than is slated for fiscal 1990. Perhaps as important to the research community, however, is a proposed increase in the number of new competing grants from 4633 in 1990 to 5095 in 1991. Last year the number of continuing grants that NIH was committed to funding put such a squeeze on new grant proposals that both researchers and NIH administrators were dismayed at the difficulty in getting a new grant funded.

The proposed 1991 figure is still well below the peak of 6446 new grants that NIH funded in 1987, but at least there is movement in the right direction. "Our heavy commitment base kept new starts down last year but this year probably won't be quite as severe," says Michael Rogers, program administrator in the National Institute of General Medical Sciences (NIGMS). "But it will be a continuing problem."

NIGMS, which accounts for about half of the NIH funds that support chemistry, would receive a 5% increase under Bush's proposal to $746 million for fiscal 1991. Within NIGMS, the pharmacological sciences program would increase 4% to $104 million; cellular and molecular basis of disease research would rise 5% to $205 million; and the biophysics and physiological sciences program would increase 5% to $152 million. Only $15.5 million, or roughly 2% of the institute's budget, would be directed to AIDS research.

Until the beginning of fiscal 1990, funding for human genome research fell within the NIGMS budget. In October 1989, however, the research project got its own center—the National Center for Human Genome Research—and thus its own budget, advisory council, and review panel. It remains to be seen whether Congress will agree to the full $108 million that the Bush Administration requested for the center this year. In fiscal 1990 Congress appropriated only $60 million of the $99 million requested.

National Aeronautics & Space Administration. R&D funds make up almost half of NASA's total proposed fiscal 1991 budget of $15.1 billion. And the $2.5 billion proposed for the controversial space station accounts for slightly more than one third of the total $7 billion R&D budget. That 43% increase, says NASA Administrator Richard H. Truly, is necessary if the agency is to launch the space station in 1995 and staff it by 1997—a schedule that has already slipped since last year.

Another program destined for big increases at NASA in fiscal 1991 is space research and technology, funding for which would rise 63% to $485 million. The funds would go toward developing new technology, including robotics, for science missions to the moon and Mars with the ultimate goal of manned trips to those destinations.

NASA also would be the big winner in Bush's proposed global-change research program. The budget requests a total of $1 billion, distributed among seven federal agencies, for research projects aimed at better understanding and predicting global change. Last year—the first that the interagency Committee on Earth Sciences pulled together a coordinated program—

Space station dominates NASA R&D budget

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Conduct of R&D	**$7017.7**	**$5499.9**	**$4327.9**	**28%**
Space station	2451.0	1717.0	877.3	43
Physics and astronomy	978.8	910.5	767.1	8
Space applications	838.2	734.2	610.2	14
Space transportation capability development	762.8	679.6	707.0	12
Aeronautical research & technology	508.9	464.6	395.7	10
Space research & technology	485.4	298.7	297.2	63
Planetary exploration	480.5	388.8	425.5	24
Life sciences	160.2	105.6	83.1	52
Transatmospheric vehicle	116.0	57.7	71.2	101
Commercial programs	98.8	63.8	53.1	55
Academic programs	49.4	35.2	—	40
Exploration mission studies	35.2	—	—	—
Safety & quality assurance	32.5	24.7	21.2	32
Tracking & data systems	20.0	19.5	19.3	3
R&D facilities	**99.0**	**112.6**	**23.3**	**−12**
TOTAL	**$7116.7**	**$5612.5**	**$4351.2**	**27%**

Note: Obligations. a Estimate. b Actual. Source: Office of Management & Budget

Bulk of global-change research funds will go to NASA

$ Millions	NASA	NSF	NOAA[a]	Energy	USDA	Interior	EPA	Total budget
Climate & hydrologic systems	$302.5	$ 29.8	$67.6	$44.0	$ 2.1	$12.2	$ 3.3	$ 461.5
Biogeochemical dynamics	198.3	32.2	13.5	9.0	7.7	2.0	3.1	265.8
Ecological systems & dynamics	90.0	8.5	4.9	10.0	35.3	10.3	19.6	178.6
Solid Earth processes	63.0	12.0	0	0	0	5.9	0	80.9
Earth system history	0	9.0	1.0	0	1.1	8.0	0	19.1
Human interactions	0	5.5	0	3.0	1.2	5.3	0	15.0
Solar influences	7.2	6.0	0	0	0	0	0	13.2
TOTAL	**$661.0**	**$103.0**	**$87.0**	**$66.0**	**$47.4**	**$43.7**	**$26.0**	**$1034.1**

Note: Proposed budget for fiscal year 1991. a National Oceanic & Atmospheric Administration. Source: Committee on Earth Sciences

global-change research got $653 million. Of the proposed $1 billion, $661 million would go to NASA, much of that directed toward its Earth Observing System program. This year's budget would fund the start of development of two polar-orbiting satellites that would take simultaneous, long-term measurements of many environmental features such as temperature, cloud cover, and ozone levels.

Research at other agencies that would be supported under the global-change umbrella include $103 million for NSF, mostly in its geosciences directorate; $87 million for the National Oceanic & Atmospheric Administration; $66 million within Energy; $47 million for U.S. Department of Agriculture; $44 million for the Department of Interior; and $26 million for the Environmental Protection Agency.

Energy Department. Research funding at the Department of Energy would grow 4% in fiscal 1991 to about $6.5 billion. R&D funding for atomic weapons and other defense projects, however, would rise only about 1%—a cut when inflation is taken into account—and other energy-related R&D would increase 6%. This reflects Energy Secretary James D. Watkins' belief that nondefense programs at his department were neglected during the previous Administration.

"During the 1980s our budget declined about 3% in real dollars," Watkins said while presenting DOE's budget. "Given that defense programs were growing, we mortgaged our future by throwing out too many other good programs."

Many of the R&D programs that fare the best in the budget proposal are tied to increasing energy efficiency and enhancing the energy supply, which are sure to be goals of the National Energy Strategy that is due to be released in April. For instance, funds for research on solar and other renewable energy sources would rise 25% to $175 million. And the budget asks for $183 million for conservation R&D, 10% less than Congress forced on the department for fiscal 1990, but a whopping increase over the $88 million the department proposed last year.

In basic research, the budget for the Superconducting Super Collider (SSC) would rise 46% to $318 million. That controversial "big-science" project is in for renewed scrutiny in Congress, as a major rethinking of its design will raise its cost at least $1 billion over the $5.9 billion total estimated a few years ago.

Despite the growing expense, however, Watkins is an enthusiastic supporter of the SSC. "If we can sell this program on its merits, this will be one of the most exciting science tools that the nation has ever come up with," he said. He also rebutted the criticism that the SSC is taking money that would go to other research, pointing to budget increases across the board for basic energy sciences and physics.

Those increases on paper can be deceptive, however. "It may appear that research budgets are going up, but the actual dollars available are remaining constant or declining slightly if you take inflation into account," says Robert S. Marianelli, director of the chemical sciences division in DOE's office of basic energy sciences.

Glossary of budget terms

Fiscal year. Year running from Oct. 1 to Sept. 30. The fiscal year is designated by the calendar year in which it ends.
Obligations. Commitments made by federal agencies to pay out money for products, services, or other purposes, as distinct from the actual payment.
Outlays. Payments for obligations incurred under Congressionally granted budget authority generally made by issuance of checks on the Treasury. Outlays during any fiscal year may be for obligations incurred in prior fiscal years or in the same fiscal year.

Note. The R&D numbers obtained from individual agencies frequently differ from those used by the Office of Management & Budget in preparing its analysis of total federal R&D funding.

Healthy increases are proposed for fiscal 1991 for both the chemical sciences division (up 8% to $151 million) and the materials sciences division (up 12% to $222 million). But Marianelli points out that the proposed increases must go to seven major user facilities that those divisions support. Given that Congress usually directs that certain pet projects be funded out of the remaining monies, Marianelli says the funds left to support research have remained about constant for several years.

National Science Foundation. The fiscal 1990 budget cycle was not a good one for NSF, but hope,

Clean coal, renewable energy gain at DOE

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
ENERGY R&D	$4005.1	$3788.5	$3387.5	6%
Basic research	2292.6	2009.0	1853.0	14
Basic energy sciences	648.7	569.8	549.3	14
Materials sciences	221.9	198.6	173.6	12
Chemical sciences	150.5	140.0	128.0	8
Other	276.3	231.0	247.7	20
High-energy physics	621.3	586.8	651.6	6
Biological, environmental research	339.2	314.0	266.5	8
Nuclear physics	330.8	290.8	256.8	14
Superconducting Super Collider	317.9	217.8	100.0	46
University research & instrumentation	34.7	29.8	26.8	16
Clean coal technology	372.0	214.7	42.4	73
Nuclear	357.8	341.8	347.0	5
Magnetic fusion	325.3	323.0	346.7	1
Fossil	202.3	445.2	377.9	−55
Conservation	182.6	202.3	178.3	−10
Solar and other renewables	175.1	140.5	152.2	25
Environmental safety and health	97.4	112.0	90.0	−13
DEFENSE R&D	2536.6	2507.5	2534.9	1
Weapons R&D, testing	1884.6	1863.8	1905.8	1
Naval reactors development	652.0	643.7	629.0	1
TOTAL	$6541.7	$6296.0	$5922.3	4%

Note: Obligations. a Estimate. b Actual.
Sources: Department of Energy, Office of Management & Budget

NSF's total budget is up 14% . . .

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Mathematical and physical sciences	$ 621.5	$ 557.0	$ 503.8	12%
Geosciences	383.7	325.0	309.9	18
Biological, behavioral, and social sciences	327.5	293.5	281.5	12
Science and engineering education	251.0	204.3	171.1	23
Engineering	226.0	200.2	187.1	13
Computer and information science and engineering	193.3	170.0	151.8	14
Antarctic program	175.0	151.9	131.1	15
Program development and management	102.5	96.4	91.3	6
Scientific, technological, and international affairs	74.0	63.5	58.3	17
Research facilities modernization	20.0	19.7	0	2
Office of inspector general	3.0	2.6	0	15
TOTAL	**$2377.5**	**$2085.1**	**$1885.9**	**14%**

Note: Obligations. a Estimate. b Actual. **Source:** National Science Foundation

. . . with funding for sciences up 10% . . .

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Ocean sciences	$ 171.0	$ 143.4	$145.9	19%
Physics	130.2	123.8	122.3	5
Materials research	123.5	116.9	115.1	6
Atmospheric sciences	120.1	104.1	98.6	15
Chemistry	103.4	97.9	96.7	6
Astronomical sciences	100.7	91.6	89.2	10
Mathematical sciences	73.7	69.1	66.0	7
Biotic systems, resources	73.4	66.7	62.8	10
Earth sciences	71.5	60.1	54.2	19
Cellular biosciences	63.1	57.3	55.5	10
Molecular biosciences	52.0	48.0	46.7	8
Behavioral, neural sciences	49.1	45.8	44.8	7
Social, economic sciences	35.5	32.3	30.9	10
TOTAL	**$1167.2**	**$1057.0**	**$1028.7**	**10%**

Note: Obligations. a Estimate. b Actual. **Source:** National Science Foundation

. . . and for chemical programs up just 6%

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Materials research	**$123.5**	**$117.0**	**$115.0**	**6%**
Project support	69.2	66.1	64.8	5
Laboratories and groups	36.9	34.6	34.2	7
National facilities	17.4	16.3	16.0	7
Chemistry	**103.4**	**97.9**	**96.7**	**6**
Physical	30.5	29.1	28.4	5
Organic and macromolecular	25.3	24.5	23.9	3
Inorganic, bioinorganic, and organometallic	17.2	16.2	16.0	6
Analytical and surface	13.7	12.9	12.7	6
Instrumentation	8.8	8.1	8.2	9
Special projects	7.9	7.1	7.5	11
Chemical and thermal systems engineering	**33.1**	**30.6**	**30.9**	**8**
Fluid, particulate, and hydraulic systems	9.2	8.6	8.8	7
Interfacial, transport, and separation processes	8.8	7.9	7.6	11
Thermal systems	8.1	7.5	7.8	8
Chemical reaction processes	7.0	6.6	6.7	6
Biochemistry	**14.7**	**13.8**	**13.5**	**6**
Cellular biochemistry	**13.6**	**12.2**	**12.0**	**11**
TOTAL	**$288.3**	**$271.5**	**$268.1**	**6%**

Note: Obligations. a Estimate. b Actual. **Source:** National Science Foundation

apparently, springs eternal. NSF started out the 1990 cycle intent on getting on track toward doubling its budget by 1992. It sought a 14% increase to $2.1 billion, including a 14% increase to $1.8 billion for research and related activities.

But Congress had other ideas. Although providing an almost 20% increase for science and engineering education in fiscal 1990 and requiring that a set amount of money be spent on a few research programs, Congress ordered across-the-board cuts in other research programs in NSF's appropriation bill. Those mandates coupled with the additional across-the-board cuts needed to meet the fiscal 1990 deficit reduction target, caused a "severe" crunch on the agency's budget, according to NSF director Erich Bloch.

So severe was the crunch that Bloch decided not to fund any of the 12 or so new science and technology centers that were planned for this year. Instead the center funds will be used to support individual research grants. Even so, NSF will be funding 4700 fewer researchers and graduate students than the 47,000 it had planned to support this year. Proposals for science and technology centers submitted in 1989 will be considered for funding in 1991.

Still, as the budget book says, this year's budget request of $2.4 billion continues progress toward doubling NSF's budget by 1993. And Bloch said, it's time for "Congress to make the investment needed" to reach the goal.

All this munificence hasn't yet trickled down to divisions of chemistry or materials science, even though they're part of a directorate—mathematical and physical sciences—whose funding is set to increase 11% to $622 million in fiscal 1991, following an 11% rise this year.

Funding for the chemistry division is slated to rise 5.5% to $103 million in fiscal 1991, after increasing just 1.2% this year. The new budget request is, in fact, $78,000 lower than that submitted for fiscal 1990. Still the chemistry division generally manages to fund about 58% of the proposals it receives and about 26% of all the proposals funded by the mathematical and physical sciences directorate each year.

In fiscal 1991, according to NSF budget documents, an increment of $2.11 million is targeted to increase support for graduate student research assistants. Another increment of $700,000 is intended for new, special-purpose instrumentation. An increase of $1.7 million will support 20 new investigators, and an increment of $900,000 will support continued growth in the 50-site nationwide program of research experiences for undergraduates. That takes care of the total $5.41 million increase requested for the chemistry division.

So the $1.2 million increase needed to fund additional interdisciplinary, interdivisional collaborative research in materials chemistry, chemical processing, and chemistry of life processes will, NSF says, "be provided by redirecting funds from more mature research activities" funded by the chemistry division.

Materials research doesn't fare much better than chemistry. Its budget is slated to increase 5.6% or

Agricultural research gets boost at USDA

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Agricultural Research Service	$ 661.1	$ 601.6	$ 576.3	10%
Cooperative State Research Service	346.9	385.6	347.0	−10
Forest Service Research	150.2	149.6	139.8	0
National Agricultural Library	15.8	14.7	14.3	7
TOTAL	$1174.0	$1151.5	$1077.4	2%

Note: Obligations. a Estimate. b Actual. Source: Department of Agriculture

EPA emphasizes interdisciplinary research

$ Millions	1991[a]	1990[a]	1989[b]	% change 1990–91
Multimedia (interdisciplinary)	$111.4	$ 85.6	$ 44.3	30%
Air	94.9	77.8	67.7	22
Superfund	71.8	76.3	73.4	−6
Hazardous waste	41.2	43.8	43.5	−6
Water quality	28.9	26.7	24.1	8
Toxic substances	28.6	26.7	27.9	7
Drinking water	22.8	21.7	21.3	5
Pesticides	15.4	12.6	13.3	22
Management and lab support	15.4	14.4	12.6	7
Energy/acid rain	14.3	32.2	54.5	−56
Radiation	4.1	3.7	3.5	11
Leaking underground storage tanks	0.8	0.8	0.8	0
TOTAL	$449.8	$424.5	$386.9	6%

Note: Obligations. a Estimate. b Actual. Source: Environmental Protection Agency

$6.52 million, to $124 million, following a 1.6% increase this year. Its fiscal 1991 budget request, at least, is $283,000 over its fiscal 1990 request. In contrast to chemistry, materials research funds just about 44% of the proposals it receives.

The materials division is requesting an increase of $3.1 million to strengthen project support, $2.35 million to establish one additional materials research group, and $1.07 million for the national facilities and instrumentation program. Support for high-temperature superconductivity research wouldn't increase, remaining at $17.3 million.

And even though Congress gave NSF $20 million in the current fiscal year for research facility modernization, the foundation, according to Bloch, doesn't intend to spend the money right now. Instead it will combine that $20 million with the $20 million it is requesting in 1991 in one combined solicitation, awarding $40 million in fiscal 1991.

Department of Agriculture. There is no budget doubling in sight for the USDA. Bush is proposing only a 2% rise in R&D funding to about $1.2 billion for the department, not enough to keep up with inflation. Within USDA, the Agricultural Research Service would get the bulk of the increase, with its R&D budget growing from $602 million in fiscal 1990 to $661 million in fiscal 1991.

Although the R&D budget for the Cooperative State Research Service (CSRS) would actually decrease 10% to $347 million, the bulk of the cut comes from the buildings and facilities category. A key feature of the proposed 1991 CSRS budget is $100 million for competitive grants under a new National Research Initiative to fund research on plant and animal systems, global change, water quality, and human nutrition. Of the total, $15 million would support a program to map genomes of economically important crop plants.

The initiative was proposed in a 1989 report by the National Academy of Sciences, which suggested the program be funded at $500 million. Secretary of Agriculture Clayton K. Yeutter said USDA could not afford such a high amount now, but plans to increase the program $50 million per year in the future.

Environmental Protection Agency. One of EPA's priorities in fiscal 1991, says Administrator William K. Reilly, is "assuring sound science." EPA's research budget would rise just 6% to slightly less than $450 million. There is, though, a significant change in priorities. Funding for multimedia research, which used to be called interdisciplinary research, is slated to rise 30% to $111 million. This increase, EPA says, will allow it to anticipate environmental concerns rather than focus on short-term regulatory concerns.

Other big increases are slated for air research, up 22% to $94.9 million, and pesticide research, also up 22% to $15.4 million. A lot of the increased effort for air research will focus on such things as assessing exposure of the overall population to air pollutants and evaluating how alternative fuels affect air quality, human health, and the environment. Pesticide research will focus on potential environmental impacts of genetically engineered organisms and developing methods to prevent pollution from pesticide use.

National Institute of Standards & Technology. NIST is set to get the largest increase since its inception—as the National Bureau of Standards in 1901, that is. Its R&D budget would rise 22%, or $36.5 million, to $198 million. Acting NIST director Raymond G. Kammer says the requested increase "is long overdue," pointing out that NIST's funding has remained flat for the past 15 years.

The increased funds are spread over a variety of programs. For example, funding for chemical measurements and standards would be up $4.3 million, bioprocessing engineering up $2.3 million, high-temperature superconductivity research up $1.9 million, and high-performance composites up $1 million.

In addition, the 1991 budget contains funding for two technology transfer programs. The $10 million requested for the advanced technology program would provide grants to industry-led consortia for research in generic, precompetitive technologies, and the $5 million requested for the regional manufacturing technology centers program would provide matching grants to universities to establish centers for transfer of new and innovative manufacturing technologies to small and medium-size businesses. □

Chemical Industry Supports Favored Trade Treatment for U.S.S.R.

Most-favored-nation status would mean lower duties on imports from Soviet Union and a start to improving economic climate there

Earl V. Anderson,
C&EN Northeast News Bureau

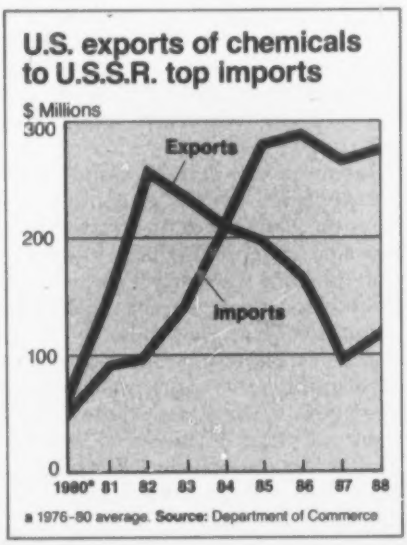
The chemical industry has not yet joined the loud and growing chorus of voices from various U.S. business interests to extend most-favored-nation (MFN) tariff treatment to the Soviet Union. However, that's only because its international experts have been too busy with other trade issues. "Quite a few of our member companies strongly favor granting MFN to the Soviets," says a trade spokesman for the Chemical Manufacturers Association.

The National Foreign Trade Council, National Association of Manufacturers, and the U.S. Chamber of Commerce have all come out recently with strong statements supporting the move to grant MFN trade treatment to the U.S.S.R. If this were to happen, imports from the Soviet Union would enjoy duties that now exist on products from most other countries, rather than the punitively high rates that they now carry.

In a report released last month, the International Trade Commission (ITC) says it found strong support for such a move. It also says the action would have little or no negative impact on U.S. companies. In fact, most of the experts contacted by ITC believe that granting MFN status to the U.S.S.R. would have very little near-term impact of any kind on the volume of U.S.-Soviet trade.

But those statements belie the symbolic importance that MFN status would have on political and economic relations between the two superpowers. Granting such status to the U.S.S.R. would signal loudly and clearly that the U.S. has a long-term commitment to sound commercial relations with the Soviet Union. It would improve the climate for U.S. companies doing business in the Soviet Union and would increase the business opportunities for small and medium-size U.S. companies, not just the multinational giants.

Stacey J. Mobley, Du Pont's vice president for federal affairs, agrees. Granting MFN status to the Soviets, says Mobley, would cast a favorable political light on all commercial relations between the two countries. More important, he adds, it would put U.S.-based companies on a more equal footing with their counterparts in other western countries who are competing for growing opportunities in the Soviet Union. Indeed, some experts contend that MFN status is an absolutely necessary precursor to worthwhile U.S. investment opportunities in the Soviet Union.



MFN treatment is the cornerstone for most trade in the western world. Basically, it means that tariff concessions granted to one country will be granted to all countries.

The Soviet Union has not enjoyed MFN status with the U.S. since 1951. A 1972 trade agreement between the two countries provided for such treatment and the president proposed that MFN status be granted to the U.S.S.R. as part of the 1974 Trade Act.

At that time, however, the MFN proposal was among the most controversial of all trade issues. Out of that controversy came the Jackson-Vanik amendment, which linked MFN status for communist countries to their willingness to allow free emigration. When the 1974 Trade Act passed with the Jackson-Vanik amendment intact, the Soviets terminated the 1972 trade agreement. As a result, it was never implemented and imports from the U.S.S.R. still do not enjoy MFN treatment.

Now there is a groundswell of opinion to grant the U.S.S.R. an exemption from the Jackson-Vanik amendment and to give it MFN status. So strong is that opinion, both in and out of government, that it almost certainly will happen, unless haggling over details sidetracks the main issue. Among the details: For how long should the exemption be granted and, rather than an exemption, should the Jackson-Vanik amendment be repealed entirely?

A U.S.-Soviet trade agreement is supposed to be ready by June. Presumably, MFN status will be a part of it. However, because of Administration officials' arguing over de-

Chemicals are important part of U.S.-U.S.S.R. trade
Other 3%
Crude materials[a] 8%
Manufactures 9%
Chemicals 10%
Food & live animals 70%
1988 U.S. exports to U.S.S.R. = $2.77 billion
Other 17%
Fuels & lubricants 33%
Chemicals 20%
Manufactures 30%
1988 U.S. imports from U.S.S.R. = $578 million
a Inedible, excludes fuels. Source: Department of Commerce

tails of the agreement, actual negotiations haven't started yet.

Without MFN, imports from the Soviet Union must contend with the higher duties listed in "column 2" of the U.S. tariff schedules. In most cases, these so-called column 2 rates are much higher than the general, or "column 1" rates. For instance, the MFN duty on ethylene glycol is 12%. Its column 2 rate, however, is a hefty 63%. For polymers of ethylene, the tariff rates are 12.5% and 43%, respectively. For vinyl polymers, they are 10.1% and 43.5%.

These high column 2 rates make it difficult for Soviet products to compete in the U.S. and, along with past politico-economic tensions between the two countries, help to explain why trade with the Soviet Union is a small part of the overall U.S. trade picture. U.S. exports to the U.S.S.R. have only been about 1% of total exports for the past 10 years. Imports from the U.S.S.R. have been a miserly 0.1 to 0.2% of the total over the same period.

The same picture emerges in U.S.-Soviet chemical trade. It simply is not much of a factor in the overall trade picture. For instance, in 1988, the last year for which data are available, the U.S. exported $273 million in chemicals to the Soviet Union and imported $117 million in chemicals from it. Both are less than 1% of their respective totals.

Chemicals are, however, a very important part of U.S.-U.S.S.R. trade. In 1988, chemicals represented about 10% of U.S. exports to the Soviet Union. Without the overwhelming presence of agricultural exports, that figure would be 33%. Chemical imports were 20% of the total imports from the U.S.S.R. in 1988. And ignoring imports of petroleum products, chemicals' share also would be about 30%.

But for most companies that advocate MFN status for the U.S.S.R., an immediate boost in U.S.-Soviet trade is not the primary goal. As Du Pont's Mobley says, a much more important consideration is that it will make U.S. companies more competitive in the rush for business opportunities in the Soviet Union.

He notes that, for the most part, Du Pont's competitors for these opportunities are not other U.S.-based companies, subject to the same restrictions as Du Pont. Rather, most of them are based in Europe. Their business goals in the U.S.S.R. receive their governments' full political support.

Japanese competitors, says Mobley, approach the Soviet market differently. They try to undertake multifaceted projects to which they then will become the major suppliers. They also aim to be the ones that export the resulting products.

Mobley knows that focused, high-level political support for business ventures in the Soviet Union may have no place in overall U.S. policy. But he does believe that granting MFN status to the Soviets would be a positive first step.

Among the results of improved business relations with the Soviets could be more investment there. According to Mobley, Du Pont and its subsidiaries, mostly those in Europe, are "actively pursuing" joint-venture arrangements with groups in the Soviet Union. The most promising right now involve agricultural chemicals, automotive finishing, and oil production. All of them, says Mobley, involve mature, nonstrategic technologies that have significant market potential in the Soviet Union. And all of them meet the economic viability yardsticks that Du Pont applies to all of its investment deals.

Nevertheless, because the Soviets have no free market mechanism and because they always push for a countertrade arrangement in their joint ventures with western countries, it is difficult to apply those yardsticks to joint-venture deals in the U.S.S.R.

Granting MFN status to the Soviets won't, by itself, change the situation. But Mobley believes that it could help foster fundamental reforms in the Soviet economic system.

With those reforms, Du Pont's business with the U.S.S.R. could grow, along with those of other U.S. companies. In 1988, Du Pont sold $147 million worth of goods to the Soviets and bought $95 million. Last year, sales to the U.S.S.R. probably stayed at about 1988's level. But Du Pont likely imported about $150 million of Soviet materials in 1989—58% more than in 1988. Its purchases included energy, petroleum products, and basic chemicals. Among its sales: agricultural chemicals, plastics, elastomers, films, electronic materials, chemicals, and medicinal diagnostic products.

The natural market for products that Du Pont buys from the U.S.S.R. is Europe, Mobley says. However, the company has imported some Soviet products into the U.S., particularly organic chemicals. The Soviet Union, he points out, is a strong, competitive producer of petrochemicals, and Du Pont uses its products as raw material to produce downstream products. Soviet *p*-xylene is a case in point. Du Pont uses it to make polyester staple, film, and other polyester-based products. □